EFFECT OF DATE OF SOWING ON FALL ARMYWORM, *SPODOPTERA FRUGIPERDA* IN MAIZE

Abstract

Fall armyworm (*Spodoptera frugiperda*) ~~was~~ is ~~the~~ a member of the ~~noctuidae~~ Noctuidae family which has ~~got~~ economic importance as a polyphagous and extreme pest of many important crops, including maize in India and elsewhere. In this context, an experiment regarding the influence of different dates of sowing on the incidence of fall ~~armyworm~~ armyworms ~~was~~was conducted in MARS, Dharwad. The results revealed that the least mean larval load of fall armyworm was recorded in crop sown during the July 2nd fortnight (0.75 larvae per plant) and the highest was recorded in crop sown during the August 2nd fortnight (1.53 larvae per plant). Whereas, the lowest mean leaf damage score of 2.95 was observed in ~~crop~~ crops sown during 2nd fortnight of July and the highest was recorded in the crop sown during 2nd fortnight of August (4.82).

~~Key words~~Keywords: Different sowing dates, Fall armyworm, Natural enemies, Maize

Introduction

Maize (*Zea mays*) is one of the ~~utmost~~ most significant cereal crops in the global agriculture economy equally as food for man and fodder for animals and is referred to as the "Queen of cereals" because of its greater yield potential. It is being cultivated both in the tropical and subtropical climatic conditions of the world. Maize produced in the country is mainly used as a human diet. Maize seeds are consumed as human food, as ~~feed stuff~~feedstuff for poultry birds and ~~for~~ cattle and also used in the production of starch, glucose and edible oil from industry. ~~An~~ The annual global production of this crop is 1016 million tons from an area of 184 million ~~hectare~~ hectares with productivity of 5,520 kg per hectare. About 35 ~~per cent~~percent of maize produce in India is utilized for consumption by humans, 48 ~~per cent~~percent is used for poultry as well as cattle feed where as 15-17 ~~per cent~~percent is used for preparation of corn flakes, corn oil, popcorn, corn syrup, dextrose and starch in food processing industries. India is the fourth largest producer with a production of 27.15 million tons in an area of 9.60 million ~~hectare~~ hectares and productivity is 2,830 kg per hectare. The major ~~maize growing~~maize-growing areas in India are Karnataka, Uttar Pradesh, Andhra Pradesh, Rajasthan, Tamil Nadu, and Maharashtra which contribute to the area and production of 60 and 70 ~~per cent~~percent, respectively. Maize is grown in an area of 1.36 million ~~hectare~~ hectares in Karnataka, and the production is 4.09 million tons ~~where as~~whereas the productivity is 3020 kg per hectare (Anon., 2018). At present, the average yields of cereal grains are lower in India due to a variety of factors, among which, ~~the~~ insect pests have been considered as one of the most important constraints. It is estimated that as many as 141 insect pests cause different degrees of damage to maize ~~crop~~ crops from sowing to harvesting (Reddy and Trivedi, 2008). Among these, stem borer (*Chilo partellus*), cob borer (*Stenachroia elongella*) and shoot fly (*Atherigona soccata*) were found to be as major pests. Stem borers are the major insect pests followed by defoliators but now, the fall armyworm, *Spodoptera frugiperda* (J. E. Smith) (Noctuidae: Lepidoptera) is a polyphagous and extreme pest of many important crops, including maize in India and elsewhere. The different recommendations on dates appropriate for sowing exist across all ~~agro-ecological~~agroecological zones where maize is cultivated. Maize cropping is between March/April (early) and August/September (late) in the Southern ~~agro ecological~~agro-ecological zone of the country (rain forest) where the crop covers a larger area. The proper sowing time is recommended considering various problems including ~~pest~~ pests and diseases. This was intended to recognize sowing dates that would result in lower infestations that are sufficient to prevent economic crop loss so that insecticide application can be minimized.

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Methodology

The experiment on this particular objective was conducted at MARS, Dharwad in *kharif* 2019 by growing the maize hybrid, R-3033. The plot size was 7 × 4 m with spacing of 60 cm × 20 cm was followed. The crop was not implicated with any kind of plant protection measures except regular agronomic practices *viz.*, tilling, fertilization, intercultivation and hand weeding operations as per the recommendation to maintain a good crop stand. The treatments consisted of 3 different dates of sowing at 15 ~~days~~ day intervals *viz.*, 2nd fortnight of July (1st date of sowing), 1st fortnight of August (2nd date of sowing), and 2nd fortnight of August (3rd date of sowing) and were replicated seven times.

Observations recorded

Incidence of fall armyworm ~~in~~ on different dates of sowing

Observations on the incidence of fall ~~armyworm~~ armyworms ~~in~~ on different dates of sowing were recorded from five randomly selected plants in each replication at weekly intervals. Further, this data was used for calculation of mean larval population per plant by using the following formula.

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$$\text{Incidence of larvae per plant (Nos.)} = \frac{\text{Number of larva}}{\text{Number of plants observed}}$$

Leaf damage

Leaf damage assessment was made on 5 randomly selected plants by using visual scale ~~ranged~~ ranging from 0 to 9. (Davis *et al*., 1992)

0 = no visible leaf damage

1 = only pin-hole damage to the leaves

2 = pin-hole and shot-hole damage to leaves

3 = small elongated lesions (5–10mm) on 1–3 leaves

4 = midsized lesions (10–30mm) on 4–7 leaves

5 = large elongated lesions (>30mm) or small portions eaten on 3–5 leaves

6 = elongated lesions (>30mm) and large portions eaten on 3–5 leaves

7= elongated lesions (>30cm) and 50 % of leaf eaten

8 = elongated lesions (30cm) and large portions eaten on 70 % of leaves

9 = most leaves have long lesions

Statistical analysis

The data obtained from all the sowing dates during the present study were subjected to one way ANOVA. The observations regarding incidence ~~was~~ were subjected to square root transformation. The differences among the treatments were compared by following Duncan's Multiple Range Test (DMRT).

Results and Discussion

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Larval load of fall armyworm in maize crop at different dates of sowing

The infestation of fall armyworm on different ~~date~~ dates of sowing showed that, the larval load of fall armyworm in the first sown crop was found to be significantly least with infestation of 0.45 larvae per plant compared to the other two dates of sowing (second (0.71 larvae/plant) and third sown crop (1.02 larvae/plant)). Similarly, the infestation level of fall armyworm was continued ~~upto~~ up to 85 DAS in maize crop sown in first sowing. However, the peak level of infestation was observed in all the sowing dates with infestation of 3.37, 2.93 and 2.25 larvae per plant in third, second and first sown crops, respectively at 36 DAS.

The study revealed that, the least mean larval load was noticed in first sown crop (0.75 larvae per plant) compared to third sown crop registered 1.53 larvae per plant. This is due to unsuitable environmental factor for pest attack *i.e* heavy rainfall as it was negatively correlated with the incidence of fall armyworm. The results of the present investigation are ~~in accordance with~~ the findings of Waddill *et al*. (1981) reported that heavy rainfall kill a significant number of early instar of fall armyworm which ~~reduced~~ reduces the adult population. Okweche *et al*. (2015) reported that damage variables and population dynamics of *C. partellus* were significantly lower in early-planted maize as compared to late-planted maize.

Leaf damage

The scoring of leaf damage by fall armyworm was significantly least in first sown crop with a leaf damage score of 0.63. The subsequent ~~sown~~ second and third dates of sown crop ~~were~~ registered higher leaf damage score of 1.14 and 1.63, respectively at 15 DAS. Similarly, the leaf damaging score was increased ~~over a period of~~throughout observation upto 85 DAS in all the dates of sowing. The peak leaf damage was noticed at 36 DAS in all the sowing dates with leaf damage score of 6.69, 5.74 and 4.63 in third, second and first sowing, respectively. However, the lowest mean leaf damage score was observed in first sown crop (2.95) followed by second date of sowing (3.78) and the highest mean leaf damage score was noticed in third date of sowing (4.82).

The lowest mean leaf damage score was noticed in first sowing (2.95) whereas, the highest mean leaf damage score was recorded in third sowing (4.82). This might be due to least larval load recorded in first sowing compared to third sowing. Results ~~pertaining to~~about the different dates of sowing which affects the incidence of fall armyworm in maize is scanty. However, Nath *et al*. (2017) reported that leaf damage caused by *Spodoptera litura* was highest in late sown groundnut crop (20th July) compared to early sown crop (20th June and 5th July).

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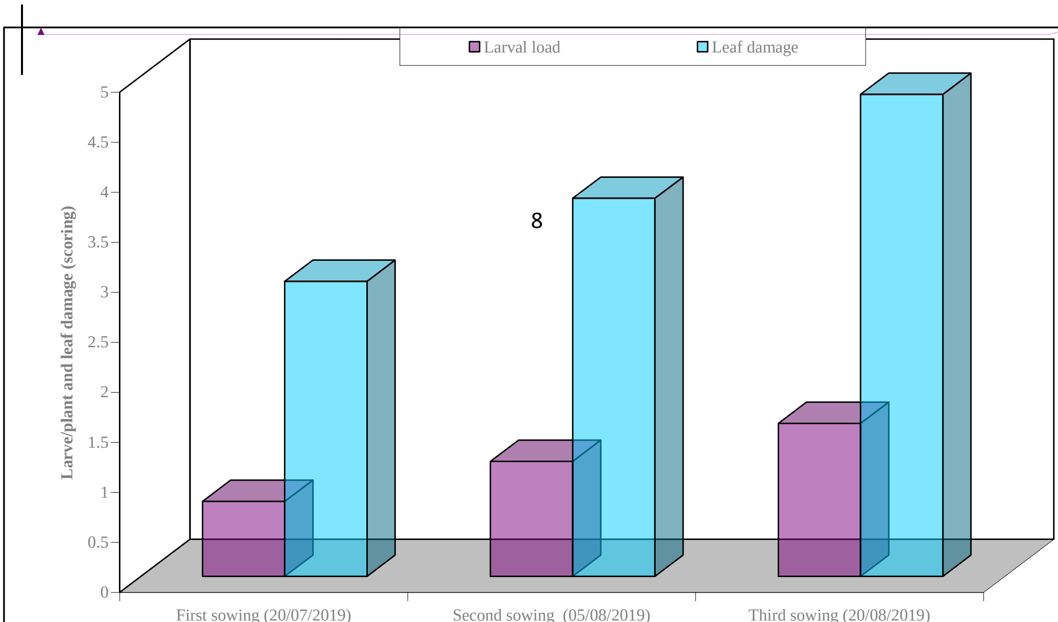

Fig 1. Influence of different dates of sowing on incidence of fall armyworm

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The study investigates the impact of different sowing dates on the incidence of fall armyworm infestation and subsequent damage in maize crops. Fall armyworm (*Spodoptera frugiperda*) is a significant member of the Noctuidae family, notorious for its polyphagous nature and its status as a major pest affecting various crops, particularly maize, in regions including India and beyond.

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This research holds paramount importance in the context of agro-environmental factors (Bertorelli and Olivares, 2020; Hernandez et al. 2018c), climate dynamics (Campos, 2023; Olivares, 2023), soil characteristics (Olivares, 2022; Olivares et al. 2022), and agronomic practices (Camacho et al. 2018) prevalent in tropical environments of Latin America, where maize cultivation forms a crucial component of agricultural activities (Olivares et al. 2016a; 2016b). Understanding the relationship between sowing times and fall armyworm infestation is essential for devising effective pest management strategies (Hernandez et al. 2018a), optimizing agricultural practices (Hernandez et al. 2018b), and ensuring food security in these regions (Cortez et al. 2019; Hernandez et al. 2017).

The findings of this study provide valuable insights into the temporal dynamics of fall armyworm infestation in maize crops (Montenegro et al. 2021a; 2021b). By elucidating the variation in larval load and leaf damage scores across different sowing dates (Hernandez and Olivares, 2019), the research underscores the significance of timing in mitigating pest pressures (Hernandez et al. 2020). Specifically, the observation of lower mean larval loads and leaf damage scores in crops sown during the July 2nd fortnight compared to those sown in August highlights the potential benefits of timely sowing as a preventive measure against fall armyworm infestation (Cortez et al. 2018; Parra et al. 2013; Guevara et al. 2012a).

Moreover, the documented differences in infestation levels based on sowing dates contribute to the existing body of knowledge regarding pest ecology and management strategies in tropical maize agroecosystems (Guevara et al. 2012b). This study adds empirical evidence to the ongoing discourse on the influence of agroclimatic factors (Parra et al. 2012; Parra et al. 2017) and agronomic practices on pest dynamics, thereby facilitating informed decision-making by farmers, agricultural extension services, and policymakers (Parra et al. 2018; Olivares et al. 2015).

In conclusion, the investigation into the effect of sowing dates on fall armyworm infestation in maize offers valuable scientific insights with practical implications for sustainable maize production in tropical environments (Cortez et al. 2016a; Olivares et al. 2016; Olivares, 2018). By elucidating the temporal dynamics of pest pressure, the study underscores the importance of strategic timing in crop management practices, ultimately contributing to enhanced agricultural resilience and productivity in the face of evolving agro-environmental challenges (Cortez et al. 2016b; Hernandez and Olivares, 2020).

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